repeated examinations by the State board of health of specimens of blood had shown the disease not to be typhoid fever.

York River below West Point.—The only oyster area near the city is a small bar below the city between the two rivers; few if any oysters are taken therefrom and the area should be permanently abandoned because of proximity to a sewer outlet. There are also storage beds in the Mattaponi across the channel one-half mile from the city. These are safe. The oyster bearing area begins about 2 miles below the city. The York River is wide, deep, and straight, and its entrance is opposite the entrance of Chesapeake Bay, consequently the volume of sea water that enters at each flood tide is enormous. The Pamunkey and Mattaponi Rivers drain sparsely, almost uninhabited, watersheds, and the lateral drainage area of the York is very narrow. Notwithstanding the heavy rain during the night before the samples were taken, the results showed *B. coli* absent in 1 c. c. samples, except in the one taken opposite a large oyster shucking house. Oyster samples scored low in every case.

Yorktown.—Yorktown is a historic community of about 136 inbabitants. The houses are away from the river and there is no public sewer there nor at Gloucester Point, a group of five or six houses on the opposite bank.

Queens Creek.—Queens Creek is a shallow, unimportant tributary which enters York River above Yorktown; one of the head streams of this branch receives some drainage from Williamsburg, a city of about 3,000 inhabitants.

Oysters from the York River are believed to be safe and free from infectious pollution.

POQUOSON RIVER.

Poquoson River is an estuary which makes into Chesapeake Bay south of York River entrance, and west of York Spit Lighthouse. About 14 feet draft can be carried into the main river. It has several small tributaries which drain well cultivated farming land, from which garden produce and wood are shipped; it also had a large oyster trade, carried in power boats to Fort Monroe and Norfolk. Owing to the "green gill," the oyster trade has been practically negligible for several seasons.

There is no community on the river or its tributaries, but a few houses are built along the shore and there is a small shipyard on Cheesemans Creek. There is also a mill for grinding crab scrap into fertilizer.

Of the six samples of water taken, all gave *B. coli* present in 1 c. c. amounts; of the seven samples of oysters one scored 32 and the others 5 or less. It is probable they would have scored higher had the water been less cold. These samples were taken soon after a

heavy rain and it is probable the *B. coli* content came from agricultural wash. In some instances the small private beds are in dangerous proximity to privies.

BACK RIVER.

Back River, Va., makes into the western shore of Chesapeake Bay about 6 miles north of Old Point Comfort. It is really a shallow tidal estuary, with a narrow, crooked channel. At its head, about 2 miles from the entrance, the river is divided into the Northwest Branch, extending northwestward about 2½ miles, and the Southwest Branch extending southwestward about 3 miles and ending in a narrow tidal gut, which extends to the suburbs of the town of Hampton, Va.

The post village of Earnest (Amory Wharf), with a population of 75, is on the north bank of the river near the entrance of Northwest Branch, and the scattered village of Fox Hill (post office name Rip Raps) is on and near the east bank of Harris or Harrison Creek, a small branch running southward just east of the mouth of Southwest Branch. The shores on both sides of the river are fairly thickly settled. On the north shore of the Southwest Branch, near its mouth, is a large stock and dairy farm, above and adjoining which is another large dairy stock and experimental farm belonging to the Hampton Normal and Agricultural Institute for Negroes. A sewer was noticed coming from the main building.

Of 24 samples of oysters and water taken upon two different trips, November, 1913, and February, 1914, three samples of water gave *B. coli* present in 10 c. c., but not in 1 c. c., and one sample gave *B. coli* present in 1 c. c. One sample of oysters gave a score of 50 with the water over the beds showing *B. coli* absent in 10 c. c. and a total count on agar of only 9. The tide was at its flood when the oysters were taken, which would explain the good quality of water, and the oysters had probably received their pollution from the stock farms on a previous ebb tide.

Oysters from this river have been noted since early colonial times, but for several years past there has been, in common with the other rivers of Chesapeake Bay, serious loss by "green gill." The oyster beds in Back River, Harris Creek, and Poquoson consist of many small beds controlled by some abutting property owners under lease, and by some under riparian rights.

Whenever open surface privies, or private sewers, are in the drainage area nearby, a certain amount of potential danger exists in beds situated immediately near shore in shallow water. Bacteriological examinations, even if they be extended over long periods, will fail to show any heavy pollution. Furthermore, no illness could follow ingestion of oysters from the area until infectious pollution was deposited, followed possibly by rains. Infection may occur in this way,

however, and only by epidemiological study and topographical observation can the origin of the outbreak be traced. It is in such localities as these that State health organizations and local officers should enforce a system of sanitary privies with proper disposal of dejecta.

JAMES RIVER, VA.[1]

Geographical description.—The basin of James River, the most important stream in Virginia, extends entirely across the southern part of the State from west to east. It is bounded on the north by the Potomac and York River basins and on the south by the basin of the Roanoke. Its entire area comprises approximately 9,700 square miles[2] with a population of approximately 600,000, exclusive of Newport News.

James River proper is formed by the junction of the Jackson and Cowpasture Rivers in the northern part of Botetourt County; these rivers rise in the Alleghany Mountains in Highland County near the West Virginia line and the headwaters of the South Branch of the Potomac. The river breaks through the Shenandoah Mountains near Clifton Forge, takes a southeasterly course, and near Balcony Falls flows through the Blue Ridge, in each instance with sharp falls over solid rock. At other points similar, though less pronounced, falls and rapids occur as the river flows through the foothills. The tidal portion of the river begins at Richmond, about 87 miles above the mouth of the river, following a series of rapids about 116 feet high. The range of altitude for the entire basin is from sea level to 4,000 feet on the crest of the Alleghany Mountains. The monthly discharge in second-feet varies from a maximum of 71,300 (June, 1907) to a minimum of 1,330 (Sept., 1907) with a mean of 9,040 in 1907 to 7,550 in 1909 (*Ibid.*, p. 37). These observations were taken at Cartersville above Richmond.

The tidal waters of the James River extend for a distance of 87 miles from Richmond to Newport News, where the river discharges into the western part of Hampton Roads, about 20 miles west of the entrance to Chesapeake Bay.

There are many tributary streams below Richmond; the only ones of importance, however, are the Appomattox, Chickahominy, and Warwick Rivers, and Pagan Creek. The course of the river, from Richmond to City Point, is extremely tortuous and the current ordinarily sluggish, as are also the currents of the Appomattox from Petersburg to City Point, and the Chickahominy River.

The mean excess in duration of ebb over flood tide at Falling Creek, 2½ miles below Richmond, is 1 hour 53 minutes; at City Point, 27 miles below, 1 hour 13 minutes; at Hog Island, 65 miles below Richmond, 25 minutes; at Warwick River, in the oyster area, 7

[1] See maps 1 and 13. [2] Water-Supply Paper 262, U. S. Geological Survey, p. 29.